

# CHEMICALS

## Project Fact Sheet



## ETHYLENE PROCESS DESIGN OPTIMIZATION

### BENEFITS

- 15% decrease in energy consumption
- 15% lower greenhouse gas emissions
- 2% higher process efficiency
- 15% reduction in overall cost of production

### APPLICATIONS

The new process methodology could have wide-spread application throughout the olefin industry, in the development of new plants as well as in the replacement of old, inefficient units. In addition, the new methodology could be applied to other chemical processes.

## INTEGRATION OF ADVANCED TECHNOLOGIES WILL UPDATE ETHYLENE PLANTS

Nearly 93 million tons of ethylene are produced annually in chemical plants worldwide, using an energy intensive process that consumes 2.5 quadrillion Btu per year. More advanced, energy efficient technologies have recently emerged; however, few have been installed in ethylene plants due to cost and lack of commercial demonstration. A step-change in energy consumption and environmental emissions can be achieved by the application of innovative equipment technologies and new process design concepts. Updating and optimizing ethylene production plants could significantly reduce energy use and greenhouse gas emissions as well as improve process efficiency.

The design of a new olefins plant (ethylene, propylene, butylene) will be developed that integrates advanced equipment such as distributed distillation, dephlegmators, membranes, expanders, gas turbines, heat pumps and mixed refrigeration systems. The latest process synthesis techniques will be incorporated into a new methodology for systematically screening different process schemes, which combines the advantages of mathematical programming, thermodynamic analysis, and sound engineering judgment. The resulting optimized olefin separations configuration could significantly reduce energy consumption and production costs as well as lower greenhouse gas emissions.

### OLEFINS PLANT



**Advances in distillation, heat transfer, chemical synthesis and other unit operations will optimize olefins manufacture.**



## Project Description

**Goal:** To develop a new process design methodology for separation systems, test and demonstrate this methodology, and develop, construct, operate and commercialize a grass-root olefins production unit.

The separation train of an olefins plant includes multiple distillation columns together with a truly enormous compressor-driven refrigeration system, a plethora of flash drums, heat exchangers and pumps, and a reactor system to reduce acetylene. Some of the most successful new design methodologies for separation systems include pinch analysis, energy analysis, and optimization of superstructures using mathematical programming. Although all of these new techniques are highly promising and have been applied to some extent commercially, no attempt has yet been made to combine these techniques into a single optimization method. Similarly, significant improvements have been made by incorporating equipment innovations into the ethylene plant design. However, there are a number of separation and other process technologies that are new or under-utilized in the ethylene industry, such as membranes and mixed-component refrigeration.

BP Amoco Chemical personnel have extensive, first-hand experience in olefins plant operations. AspenTech's Advanced Process Design Group has a proven track record of improving ethylene process design to provide energy, capacity and investment reduction benefits. Combined, the project partners aim to integrate the latest technologies to develop an optimized olefins plant.

## Progress & Milestones

At present, work is progressing on appraising the current technology situation through surveys and benchmarking. Future research will:

- Develop integrated design methodology
- Model, simulate, and optimize short-listed processes  
Define site-specific data
- Develop process specifications
- Prepare techno-economic evaluation
- Select engineering contractor
- Execute engineering, procurement, construction, commissioning and start-up of unit
- Operate and evaluate project

## Commercialization

Internally, BP Amoco Chemical plans to use the new process technology as they add capacity, either through expansion of existing olefins plants or construction of new plants. Externally, they plan to offer the new technology globally for license to other olefins producers.



### PROJECT PARTNERS

BP Amoco Chemical  
Naperville, IL

Aspen Technology  
Cambridge, MA

### FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Charles Russomanno  
Office of Industrial Technologies  
Phone: (202) 586-7543  
Fax: (202) 586-1658  
[charles.russomanno@ee.doe.gov](mailto:charles.russomanno@ee.doe.gov)

Please send any comments, questions,  
or suggestions to  
[webmaster.oit@ee.doe.gov](mailto:webmaster.oit@ee.doe.gov)

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Office of Industrial Technologies  
Energy Efficiency  
and Renewable Energy  
U.S. Department of Energy  
Washington, D.C. 20585



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